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ABSTRACT

This paper offers an alternative view of computer applications within classroom education as an initial step in the direction of a more teacher-centered approach to the integration of computer applications into classroom teaching. Accordingly, the view suggested in this paper approaches computer applications within the context of the teaching theory teachers have been found to identify their teaching activities with. Such a teacher-centered view of computer applications may lead to a better understanding of the purpose and value of these applications by teachers and teacher trainers, thereby providing a better foundation for their increased and improved use. The first section offers a categorization of computer applications according to their function in the classroom as a tool or as a vehicle for instruction. The second section looks at computers in classrooms today. The third section discusses teachers' views on teaching. The fourth section explores the capabilities of computer applications to support the following approaches to teaching: (1) computers and knowledge transfer; (2) computers and learner shaping; (3) computers and learning through exploration; and (4) computers and the intellectual and emotional development of the learner. (Contains 19 references.) (Author/MES)

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Fitting modern technology into established teaching practices

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ABSTRACT

The rapid expansion of computer-based technology offers increasing opportunities for the deployment of computers in schools, and there is a strong belief that this new technology can greatly support teaching. However, the promoters of the introduction of computers often base their enthusiasm on technical and functional capabilities of the computer. Little attention is paid to the problems and issues teachers are faced with when having to incorporate computer applications into their teaching practices. Although it is argued that computers can add value to the experience of learning, it has largely remained unclear how exactly teachers can maximise these values within their teaching practices.

It is the objective of this paper to offer an alternative view of computer applications within classroom education as an initial step in the direction of a more teacher-centred approach to the integration of computer applications into classroom teaching. Accordingly, the view suggested in this paper approaches computer applications within the context of the teaching theory teachers have been found to identify their teaching activities with. Such a teacher-centred view of computer applications may lead to a better understanding of the purpose and value of these applications by teachers and teacher trainers thereby providing a better foundation for their increased and improved use.

INTRODUCTION

The fast advancement of computer technology is said to offer numerous opportunities for the deployment of computers in schools, and there is general agreement that computers must be integrated into our teaching practices. Apart from the general opinion that children should become familiar with computer technologies at an early age, computers are also considered to be useful for the support of teaching.

However, due to the great enthusiasm and pressure to introduce computers into teaching the decision to introduce computers is often not made with the appropriate care and computers in schools frequently fail to be used successfully or at all. The promoters of the introduction of computers often base their enthusiasm on technical and functional issues and believe that putting computers into every classroom is sufficient to initiate their contribution towards teaching. Little attention is paid to the problems and issues that are encountered within the context in which the technology is used (Cole 1997).

This paper argues that a more successful use of computers in classroom teaching requires a better understanding by the teacher of how computer technology can support or complement his or her particular style of teaching. It is the objective of this paper to offer some guidance for teachers towards an alternative view of computers in classroom education. This view approaches computer applications from the perspective of the teaching theory teachers have found to identify their teaching activities with. Such a teacher-centred view of computer applications may lead to a better understanding of the purpose and value of these applications by teachers thereby providing a better foundation for their increased and improved use.

For this purpose this paper first presents an overview of the functionalities of the computer in classroom education. This investigation addresses the use of the computer as a tool for information

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manipulation, representation and access and the use of the computer as an application that adopts a tutoring role. The paper then continues with an investigation of the theories of teaching that underlie current teaching practices in schools and offers some guidance on how the different current computer applications can be used within these different theories.

COMPUTERS IN CLASSROOM EDUCATION

This section offers a typical categorisation of computer applications according to their different functions in the classroom. This categorisation encompasses the computer in its dual role as a provider of tools to be learned and as a tool for learning in order to provide a basis for discussion on how these functional capabilities can best be employed in classroom teaching.

The computer as a tool

The so-called content-free computer applications, such as spreadsheets, graphics packages, word processors and database management systems, form a major part of this category (Collins et al. 1997). These applications provide pupils with flexible tools that allow them to organise data and construct and explore relationships that otherwise might be very time-consuming or difficult to produce. A word-processor, for example, allows the learner to restructure text quickly, check the spelling and produce a document of high quality.

The computer also provides a tool for easy access to large information resources of various formats including text, pictures, videos and sound. A popular component of education which takes advantage of these capabilities is resource-based learning (Taylor and Laurillard 1995). The fundamentals of resource-based learning include question formulation, searching, finding and integration of information.

One obvious reason why learning how to use these tools may seem important is that these applications are increasingly considered as part of our everyday life having penetrated both the home and the workplace (Mason 1995). However, a further significant advantage of using these tools is that the learner does not only get familiar with the mechanics of retrieving, writing, designing and storing information, but that at the same time these skills can be used within a worthwhile project (Bonnett 1997).

The computer as a vehicle for instruction

The idea of taking advantage of computer technology to serve as a 'teaching machine' first emerged in the 1950s with the development of the first computer-assisted learning systems. These systems may be described as automated presentation devices that have been built based on the theory of education that views learning as a process in which knowledge is communicated from teacher to student (Elsom-Cook 1991).

However, these applications were soon criticised for remaining teacher-centred and offering little more than test and drill. Being able to adapt to the needs of the individual and providing feedback to the learner became an increasingly important demand from computer-based tutors, and intelligent tutoring systems were developed as systems that were able to provide individualised tutoring. Intelligent tutoring systems provide helpful guidance and make the teaching process more adaptable to the student by exploring and understanding the student's special needs and interests, and by responding to these as a human teacher does (Winkels 1992, Park et al. 1987).

Computer-based games and simulations are also viewed as facilitators of learning. Simulations do so by mimicking reality and games by providing the student with entertaining challenges.

COMPUTERS IN CLASSROOMS TODAY

The previous section has given an overview of the diverse applicability of the computer in the classroom giving evidence of the vast range of opportunities for computers in schools. However, the results of putting computers into classrooms are remarkably consistent. The computer has hardly been incorporated into conventional teaching

approaches. Most teachers still centre their teaching around familiar teaching aids such as the textbook and the blackboard (Hodas 1996).

One reason is certainly the worry that computers bear certain risks, such as the replacement of teachers by computers or the depersonalisation of the learning process through the elimination of human-to-human communication. A further issue is the fear that the use of computers may lead to the more humanistic approaches to learning being dominated by a clear cut, scientific approach (Mason 1995).

The lack of sufficient funding is another reason often mentioned for the failing success. As a consequence we are still left with a restricted number of computers in our classrooms. Although more financial resources are certainly required to equip more schools more appropriately, there have been signs that more resources will be assigned to information technology in the classroom in the near future (Stammers 1997). However, the lack of funding cannot be an explanation for the poor use of the computers that do exist.

A more significant fact is that the evolution of computer use in the classroom has been very much technology driven with little attention to factors that go beyond the theoretical issues of the functionality of the computer. The lack of experience with computers in schools and the novelty of this technology have not left time to establish teacher training schemes that prepare teachers appropriately. Also, many in-service teachers are known for their reluctance to make use of this new technology not only because they do not feel confident, but also because it is unclear how the wide range of computer applications can best be integrated into the existing teaching practices (Collins et al. 1997).

A crucial factor that hinders the successful use of computers in the classroom, therefore, appears to be the lack of sufficient and appropriate guidance for teachers to choose and use computer applications. The teacher is the key to successful use of IT in the classroom (Scrimshaw 1997). Although acquiring the skills required to handle the applications is a necessary condition for the use of computers in the classroom, a broader view of computer literacy that goes beyond the acquisition of skills is needed in order to understand and maximise its contribution to education (Loveless 1997). In order to make effective use of computer applications the teacher not only has to be confident with the use and management of the technology, but she also has to be clear about how she can make use of it in the context of her understanding of, and beliefs about, teaching. Accordingly, teachers do not only need to acquire the skills required to operate the new technology. They also need to acquire the understanding required to make a choice of an application for a particular pupil and subject within their individual pedagogic framework.

The following section, therefore, looks at the activity of teaching from the perspective of the teacher. Teaching theories are presented as the role teachers perceive themselves to play when carrying out their teaching tasks. This investigation of 'teacher-centred' teaching theories will then serve as guidance for the categorisation of existing computer applications thereby establishing issues for consideration and ground for discussion when planning for future teacher training.

TEACHERS' VIEWS ON TEACHING

In order to provide some guidelines on how teachers may integrate the use of the computer into their teaching practices this section explores the activity of teaching from the teacher's perspective. Different views of teaching, as perceived by teachers, are presented. The computer applications introduced above are then revisited and assessed according to their suitability for supporting the traditional teaching activities that are carried out as part of the different views of teaching. Such a teacher-centred categorisation of computer-based learning may contribute towards the (better) understanding and integration of computer technology in today's classroom.

Teachers have shown to have a range of views about what they mean teaching to be and what role they play within the activity of teaching. These views have been represented by Fox (1983) within four theories of teaching: transfer theory, shaping theory, travelling theory and growing theory.

Within transfer theory learning is seen as a process in which knowledge represents a commodity that needs to be transferred from the teacher to the learner. The learner is perceived as a container which has to be filled with the teacher's knowledge in an effective manner. Promoters of the transfer theory, therefore, believe that a well organised and structured process of transferral and well prepared learning materials according to the needs of the learner are the requirements for successful teaching.

Shaping theory views the learner as having to be shaped into a particular specification. Teachers feel teaching involves the production or development of particular abilities, views and attitudes. This shaping is generally carried out by the teacher through giving a demonstration of particular abilities or qualities and then getting the student to practice these through exercises.

Travelling theory distinguishes itself from the two theories above in that the learner has a notable influence on the kind of learning process, the pace in which learning takes place and the subject area to be studied. Travelling theory can best be explained through an analogy in which learning is viewed as a journey through the countryside of knowledge with the teacher acting as the travel guide. The learner is free to explore the countryside, and the subjects to be studied represent more or less challenging features of this countryside. The teacher knows the areas to be explored and follows the learner along his explorations offering helpful suggestions of where to go and what to look for. Occasionally the teacher may change into a fellow explorer himself when presented, by his pupils, with a view from a slightly different perspective he has never encountered before. In this sense teaching is a matter of providing guidance rather than clear instructions on how to get from a starting point to the end of the journey of learning.

Finally, within growing theory the teacher can be viewed as a gardener within the student's mind. Like the travelling theory it recognises the importance of the contribution of the student to the teaching process. It also views the role of the teacher as largely responsive rather than as a provider or shaper of knowledge. However, whilst the travelling theory is more concerned with the subject that is being learned, growing theory emphasises the development of the learner as a human. In this sense the subject under study is only relevant in respect to the impact it has on the personal growth of the learner. As a gardener within the student's mind it is the teacher's job to 'cultivate the garden' requiring him to 'nurture' certain abilities and characteristics whilst 'eliminating or reshaping' others.

This section has shown that teachers can base their teaching practices and the way they view their role as a teacher on a range of different teaching theories. There are, of course, a number of factors that influence the teacher's choice for one particular theory. Apart from the teacher having a particular preference for a particular approach it may depend on factors such as the experience of the teacher, the subject being taught or the advancement level of the learner. Also, it remains debatable which choice is the ideal one for a given situation. However, within the context of this paper it is merely relevant that these views exist, and that teachers can normally identify their teaching practices with at least one of these teaching theories.

COMPUTER APPLICATIONS AND EXISTING TEACHING PRACTICES

In order to provide some guidelines on how the use of computer applications may be better understood within the individual teaching practices of teachers and thereby lead to their (more successful) use, this section explores the capabilities of different computer applications to support the approaches to teaching discussed above. Rather than viewing the computer and its capabilities in isolation the views of teaching outlined above are revisited in order to investigate how different computer applications may support the teaching practices associated with them and open up new opportunities for teaching.

Computers and knowledge transfer

The advocates of the transfer theory believe in the importance of a well structured and organised preparation and transferral of learning materials for a teaching process in which the learner takes up the role of the receiver of knowledge. Drill and practice programs and intelligent tutoring systems can support well organised and structured knowledge delivery. They can provide a teaching situation in which the learner assumes a receiving role. Complete guidance is given by the software, and teacher interference is only required should the learner have difficulties with the functionality of the software.

In this way drill and practice programs, in particular, can significantly help the teacher with mundane consolidation work (Bonnett 1997). Additionally, these applications can generally provide a more stimulating and attractive context in which knowledge can be presented and exercises carried out than, for example, a book of exercises.

Computers and learner shaping

The pursuit of the shaping theory is generally associated with activities within science laboratories and engineering workshops where the teacher gives demonstrations to teach learners particular phenomena or skills (Fox 1983). Intelligent tutoring systems can offer a wide range of learning strategies. Strategies, such as cognitive apprenticeship and successive refinement are frequently implemented. Cognitive apprenticeship is based on the idea that cognitive skills can be learned in the same way as an apprentice in the crafts learns, by watching an expert in action and asking questions. The apprentice starts with the performance of small separate tasks which are gradually increased in size or linked to other tasks until the apprentice is able to perform the entire task by himself. Successive refinement is based on the principle that the material to be taught should be explained to the student in steps with gradually increasing levels of detail. This way the student is provided with an initial framework into which subsequent teaching of the domain can be fitted. Based on these strategies intelligent tutoring systems have the capability to present a step-by-step demonstration or explanation of the material or the skill to be learned. Similarly, software simulation packages can provide an experimental environment in which a situation can be repeatedly simulated, i.e. demonstrated, to the learner.

Intelligent tutoring systems and simulations, therefore, can support the focused establishment and development of particular abilities, views and attitudes as required within the shaping theory.

Computers and learning through exploration

Within the theory of teaching as an exploratory journey through the subjects under study the learner is expected to have a notable influence on the kind of learning process, the pace at which learning takes place and on the subject area that is being studied.

There are numerous software applications that provide the learner with an environment in which he can adopt the role of an explorer (Scrimshaw 1997). Encyclopaedias on CD-ROMs and adventure games, for example, encourage students to explore. Within these applications the learner has control over the nature of and the order in which the subject material is being accessed whilst it is the job of the teacher to supervise and support the explorations of the student. Games have the additional advantage that they tend to motivate students (Lardinois 1989).

Productivity tools, such as word processors and graphics packages, offer opportunities for teachers to set up specific 'landscapes' in which the student can then be encouraged to explore certain issues or

concepts (Scrimshaw 1997). The teacher may, for example, present his students with a pre-filled spreadsheet or database for the student to explore.

At the same time these kinds of applications have the inherent capability to adjust themselves to their users. Users can choose the level of complexity of their input they feel comfortable with, thereby reducing the risk of frustration and turning learning into a motivating experience.

A further way in which teachers can use the computer in order to implement the idea of learning through exploration is through the idea of computer-supported collaborative learning. Whilst teaching is often viewed as an individualised process in which the activities of the learner are only assisted by the teacher, it has also been argued that cognitive development is also socially located. Accordingly, in the way the teacher is also required to adopt the role as a peer learner within the exploratory teaching process offering an alternative perspectives upon a view within an exploration, it is claimed that the collaboration of learners within such an exploration reveals learners' different learning approaches and understanding of the material to be explored (Lesgold et al 1992). When two people bring different viewpoints to a task, they may achieve greater insights from trying to reconcile the two positions. A pupil can benefit from this kind of consultation with a companion since the companion can foster the development of knowledge through the so-called social-cognitive conflict.

Recent experience has shown that groupwork at the computer offers particular benefits. There is evidence that in front the computer children tend to collaborate rather than just work alongside each other which is often the case in typical school group work (Jones 1995). There is further evidence that, when working on a task, children ask each other for help rather than relying on the teacher. Besides, collaborative work at the computer can naturally convert the problem of lack of computers into a virtue.

There are many computer applications that offer unexpected opportunities for collaboration. Content-free packages such as word-processors and databases, for example, offer a flexible tool that allows both individual and group activities (Kaye 1995). Drill and practice applications and intelligent tutoring are largely restricted to use by individuals, although the increasing popularity of collaborative teaching has led to the development of some systems that account for the use by more than one pupil.

So far there are only few research results on children working with a computer in groups. However, it is important that teachers understand the opportunities for collaborative learning with computers whilst further research is carried out to identify the factors that contribute towards, or hinder, the success of collaborative learning.

Computers and the intellectual and emotional development of the learner

Following the growing theory means nurturing a learner's intellectual and emotional development. The subject under study is only relevant in regards to the impact it has on the personal growth of the learner.

Again, productivity tools, such as word processors and graphics packages, can provide a suitable environment. The learner can be left to be creative in words and pictures in an unstructured and spontaneous manner (Scrimshaw 1997). Similarly, programming languages require the user to be creative and express his conception of a process. Databases allow for the storing and retrieving of data in structures that are meaningful to the individual.

It is further argued that the intellectual and emotional development of the learner is often promoted by the social interactions between learners (McConnell 1994). In this sense computer-supported collaborative learning can not only provide an environment that encourages teaching through exploration, but it can also support the intellectual and emotional development of the learner. Computers have shown a significant impact on the social dynamics within the traditional classroom by encouraging, and enforcing, group activities (Davis et al. 1997). The teacher often experiences this shift towards more group activities as a disturbance of her conventional teaching routines, although classroom teaching could gain from such activities if their benefits were better understood and recognised by the teacher.

This section has categorised software applications according to the support they may give within the teaching theories explored earlier. This categorisation offers some general guidelines to teachers on how the computer can fit into their teaching practices. It is not meant to be a detailed account on how to go about using computers in schools. It merely offers a suggestion on how computer technology can be

viewed from an angle that is not merely based on the technical functionality of an application but on the ways teachers perceive their activity of teaching. In this way it is meant to offer an initial guideline on how teachers can approach the computer as an opportunity to enrich the teaching practices they feel confident and comfortable with.

CONCLUSION

There is ample evidence that putting computers into classrooms is not sufficient to guarantee their (successful) use. In order to promote the use of computers within teaching teachers do not only require an understanding of how to operate the technology. In order to view the computer as a useful and effective teaching support rather than a burden, teachers need to familiarise themselves with the possibilities of the technology within their individual teaching approaches.

This paper offers a possible direction towards a better integration of computer technology into classroom teaching through a stronger consideration of the needs of the teacher. This paper has presented a categorisation of computers in education according to the services they can provide. The paper then continues by looking at the views and understanding teachers have of their own teaching. These views are then used as categories for which different kinds of suitable computer applications are identified based on the characteristics of the teaching approach pursued within these views.

The ideas presented in this paper attempt to be a mere pointer in the direction of a more teaching-centred approach towards the introduction of computer technology. In no way do they claim to be definite answers to problems within a newly explored and rapidly developing field. They should be seen as a possible starting point towards a more effective integration of computer applications into classroom teaching in which the role of the teacher will go beyond that of a technical adviser towards a competent user and manager of these applications. Only if we recognise the crucial role of the teacher, can the potential of computers be used to enrich teaching and learning in our classrooms.

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